

Decades later

Lessons from America's first space station hold their value two decades later. Story on Page 3.



Windy center

Grounds keepers were kept busy this past week cleaning up after a storm that downed limbs around the center. Photo on Page 4.

Space News Roundup

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Columbia takes shuttle fleet past one-year milestone

With the return of the Space Shuttle *Columbia* following STS-55, its 14th mission in space, just over a full year of flight time has been accumulated by the space shuttle program.

In that time, a number of significant statistics have emerged.

The one-year mark was surpassed at 10:01:42 a.m. CDT Wednesday, and with a landing at 9:30 a.m. CDT Thursday, the total accumulated shuttle flight time stands at 356 days, 23 hours and 28 minutes.

"We think it's appropriate that it happened on *Columbia*, the first

one to fly back in 1981 and we're proud to be the crew that was on board when we did achieve that record," STS-55 Commander Steve Nagel radioed to the ground.

The shuttle flight era began with STS-1 and the launch of *Columbia* on April 12, 1981, with Commander John Young and Pilot Robert Crippen. Since then, shuttles have carried 670 major fixed payloads, experiments, and deployable payloads, totaling 822 tons, to orbit and returned 636 weighing at total of 425 tons.

Representing only 5 percent of all U.S. space launches, shuttles

have carried 56 percent of all U.S. payloads to orbit and 44 percent of all U.S. cargo weight to orbit.

Fifty-one satellites have been deployed, five of which were returned on the same flight. Three of the satellites were interplanetary probes to Venus (Magellan), Jupiter (Galileo), and the Sun (Ulysses). Three were orbiting observatories — the Hubble Space Telescope, the Gamma Ray Observatory, and the Upper Atmosphere Research Satellite. Others were communications satellites and experiment platforms such as the Long Duration Exposure

Facility which orbited Earth for nearly six years before being retrieved and returned to Earth. Two communications satellites, the PALAPA-B2 and WESTAR-VI, were later retrieved, returned to Earth for refurbishment, and relaunched.

Scientific studies aboard the shuttle and in Spacelab modules carried in their payload bays have investigated life sciences, materials sciences, combustion science, solar science and physics, space plasma physics, atmospheric studies, biotechnology, earth observations, astronomy, and the study of

the behavior of metals, semiconductors, bio-processing, and fluids in microgravity. Time accumulated in Spacelab science operations, alone, stands at 96 days and 13 hours.

Including 16 non-U.S. flyers representing 10 different countries, 161 individuals have flown at least once on the shuttle. Astronauts have conducted 16 rendezvous operations, the retrieval and repair of three satellites, and 20 space walks totaling more than 223 hours. Six of the space walks were untethered free flights using the manned maneuvering unit.

Seddon injures foot in training

Dr. M. Rhea Seddon, payload commander on Spacelab Life Sciences-2 mission scheduled for launch this fall, broke four bones in her left foot last Monday during a routine training exercise at JSC's orbiter training facility.

The STS-58 crew was practicing emergency egress from the orbiter, using an inflatable slide similar to those used by the airline industry for landing emergencies to evacuate passengers. As Seddon was sliding down the slide, her left foot became pinned under her, causing four minor metatarsal bones to break.

"There will be no impact to the mission because of Seddon's injury," Flight Crew Operations Director David C. Leestma said.

"She may miss a small amount of training in the next two weeks, but she is an experienced astronaut and most of these early training activities are refresher courses. She will return to full-time training in two to four weeks."

A safety review team lead by Gary Jackson of JSC's Safety Division has been established as a precautionary measure to investigate the incident.



The STS-55 crew shows off a banner full of Spacelab D-2 emblems during a German-language news conference. In front are German Payload Specialists Hans Schlegel, left, and Ulrich Walter. Behind, from left, are Mission Specialists Charlie Precourt, Jerry Ross and Bernard Harris, Commander Steve Nagel, and Pilot Tom Henricks.

Spacelab D-2 brings home wealth of data

The Space Shuttle *Columbia* ended its extended Spacelab D-2 mission at 9:30 a.m. CDT Thursday at Edwards Air Force Base, returning a wealth of scientific data and biological samples to Earth for further study. A scheduled landing at Kennedy Space Center was waved off due to cloudy weather conditions.

Officials from both NASA and Germany called the 88 investigations of how living beings, materials and robotic devices function in microgravity, and the Earth observation, atmospheric physics and astronomy studies an important success.

"In all, I can say we have many good results, many experiments which are well above 100 percent and we have no experiment which didn't get at least one performance working well," said Walter Brungs, the head of D-2 engineering. "Everyone in Germany is happy and we are near the point of celebration. The crew did a marvelous job."

Commander Steve Nagel, Pilot Tom Henricks, Payload Commander Jerry Ross, Mission Specialists Charlie Precourt and Bernard Harris, and Payload Specialists Hans Schlegel and Ulrich Walter will undergo detailed medical evaluations at Edwards and upon return to JSC.

Mission managers elected to extend the mission for a 10th day in orbit when it was clear that the liquid hydrogen and oxygen reactants that power the orbiter and its experiments were plentiful enough. The additional time in orbit was utilized by the various experiment teams at the Payload Operations Control Center in Oberpfaffenhofen, Germany.

Among the interesting results of the mission:
•The common garden cress developed in an unusual fashion in microgravity, with stalks growing in every direction in a miniature Spacelab hot house. Experimenter Dieter Volkmann of Bonn University hopes to gain insight in to the intricate static system of plants that allows them to withstand high winds and thunderstorms.

•Telescience worked well for the first time on a mission involving humans. The Holographical Optical Laboratory



Briefings, panels, parties recall Skylab years

This Friday marks the 20th anniversary of the launch of Skylab, America's first space station, and JSC will celebrate with a host of briefings, panel discussions, tours and a party.

The anniversary observation begins Wednesday with reminiscences by Dennis Webb and Barbara Pearson about what it was like to be a cooperative education student during the Skylab program. The brown-bag lunch event begins at 11 a.m. in Bldg. 4S, Rm. 1328.

On Thursday, Jim Oberg will discuss what the Russians were really up to in

both of their space station programs. That discussion will begin at 11:30 a.m. in the Bldg. 30 auditorium.

Six systems round-tables, featuring informal discussions between Skylab operators and space shuttle and Space Station *Freedom* workers are being scheduled in Bldg. 4S, Rm. 1328. The session on guidance, navigation and control will be from 1-3 p.m. Tuesday. The session on electrical power systems will be from 3-4 p.m. Wednesday. The session on environmental and thermal control systems will be from 8:30-10:30 a.m. Thursday. Sessions on train-

ing, planning and data management systems also are planned, but no times have been announced.

Also throughout the week, the four NASA-produced movies that focus on the Skylab program will air on the JSC Television Distribution System.

Friday, the biggest day of the celebration, will begin at 8:15 a.m. with opening statements by JSC managers including Frank Hughes, chief of the Mission Operations Directorate's Space Flight Training Division, at Space Center Houston. After that, there will be

Please see **SKYLAB**, Page 4

Endeavour work moves to launch pad

Early June mission to feature first use of Spacehab module

The Space Shuttle *Endeavour* is on station at Kennedy Space Center's Launch Pad 39B, undergoing preparations for the first mission to use the Spacehab middeck expansion module.

The STS-57 mission also will feature the retrieval of the European Retrievable Carrier satellite, which has been studying material and life sciences and radiobiology in microgravity since being deployed in July 1992 by the STS-46 crew.

Endeavour is now scheduled for launch in the first week of June. The six-person crew will stay in a 287 statute mile orbit of 57 degrees

for almost eight days.

KSC technicians are scheduled to load hypergolic fuels today and tomorrow, with the flight readiness test set for Wednesday.

Commander Ron Grabe, Pilot Brian Duffy, Mission Specialists David Low, Janice Voss, Nancy Sherlock and Jeff Wisoff will travel to Florida this week for the terminal countdown demonstration test, which is scheduled for Thursday and Friday.

Endeavour will fly with the engines that were on *Columbia* when its March launch attempt was aborted. Those engines were refurbished after engineers deter-

mined that the last-second abort was caused by rubber-like contaminants that became lodged in a preburner check valve seat, causing pressure to rise too high in the helium purge system. The valves close before ignition to shut off the helium flow and prevent propellant gases from getting into the lines.

Meanwhile, *Discovery* is in the Orbiter Processing Facility, being deserviced following April's STS-56 mission. All three main engines have been removed, and the main engine control verification test and crew cabin leak checks have been completed.



McDonnell Douglas technicians John Pearce, left, and Ron Hargett install an experiment inside the commercially owned Spacehab-1 module. The Environmental Control and Life Support Subsystem Flight Experiment was one of a variety of experiments integrated into the the pressurized module at the Spacehab Payload Processing Facility at Cape Canaveral, Fla.

NASA Photo

Please see **SPACELAB**, Page 4

JSC

Ticket Window

The following discount tickets are available for purchase in the Bldg. 11 Exchange Gift Store from 10 a.m.-2 p.m. weekdays. For more information, call x35350 or x30990.

Astroworld Early Bird Special — Tickets purchased before May 31 and used before June 30 at \$15.95.

Sea World in San Antonio — Discount tickets: adult, \$19.75; child (3-11), \$13.15.

Fiesta Texas, San Antonio — Discount tickets: adult, \$18.35; child (4-11) \$12.75.

Space Center Houston — Discount tickets: adult, \$7.50; child (3-11) \$4.50; commemorative: \$8.75.

Metro tickets — Passes, books and single tickets available.

Movie discounts — General Cinema, \$4.50; AMC Theater, \$3.75; Loews Theater, \$4.

JSC

Gilruth Center News

Sign up policy — All classes and athletic activities are first come, first served. Sign up in person at the Gilruth Center and show a badge or EAA membership card. Classes tend to fill up four weeks in advance. For more information, call x30304.

EAA badges — Dependents and spouses may apply for photo identification badges from 6:30-9 p.m. Monday through Friday. Dependents must be between 16 and 23 years old.

Defensive driving — Course is offered from 8 a.m.-4:30 p.m. May 15. Cost is \$19.

Weight Safety — Required course for employees wishing to use the Gilruth weight room is offered from 8-9:30 p.m. May 5 and 20. Pre-registration is required; cost is \$5.

Aerobics — High/low-impact classes meet from 5:15-6:15 p.m. Tuesdays and Thursdays. Cost is \$32 for eight weeks.

Exercise — Low-impact class meets from 5:15-6:15 p.m. Mondays and Wednesdays. Cost is \$24 for eight weeks.

Aikido — Martial arts class meets Tuesdays from 6:15-8 p.m. Cost is \$15 per month.

Tennis — Classes meet for six weeks from 5:15-6:45 p.m. Beginner class meets Mondays. Intermediate class meets Wednesdays. Cost is \$32.

Scuba — Classes meet Tuesdays and Thursdays for four weeks beginning June 17. Cost is \$190, with a \$50 deposit required at registration.

Fitness program — Health Related Fitness Program includes medical examination screening, 12-week individually prescribed exercise program. Call Larry Weir, x30301.

JSC

Swap Shop

Swap Shop ads are accepted from current and retired NASA civil service employees and on-site contractor employees. Each ad must be submitted on a separate full-sized, revised JSC Form 1452. Deadline is 5 p.m. every Friday, two weeks before the desired date of publication. Ads may be run only once. Send ads to Roundup Swap Shop, Code AP3, or deliver them to the deposit box outside Rm. 147 in Bldg. 2. No phone or fax ads accepted.

Property

Rent: Galv condo, furn, sleeps 6, Seawall & 61st St, cable, wknd/wkly/daily. Magdi Yassa, 333-4760 or 486-0788.

Rent: LC, Pecan Forest 3-3-2, FPL, fenced, clean, no pets, \$795/mo. 554-6200.

Sale: University Trace condo, 1 BR, study, 1-1/3 baths, W/D opt, sec alarm, cov parking, brwn carpet, new paint, avail 5-24, \$495/mo. x48621 or 480-2417.

Sale: Dickinson Bayou Water Front 4-2-5-2, pool, 100 yr old trees, WB, FPL, volleyball and horseshoe setup, \$224k. x34354 or 337-1640.

Rent/Sale: Baywind II condo 1-1, W/D, refrig w/ice maker, dishwasher, FPL, near pool, ground floor, \$425/mo. avail immed. Steve, x49625 or 486-8047.

Sale: Pearl and Sunset Meadows, 3-2-5-2, study, formals, 2000 sq ft, 2 story, 2 yrs old, \$110K. Jim, 482-8800.

Lease: NASA & FM270, TH, 2-2.5, 1500 sq ft, gar opener, lg master BR, FPL. x37008 or 452-3361.

Lease/Sale: Alvin, 3-1.5-2, patio, trees, fenced, no pets, \$600/mo or \$60K. x31798 or 585-2416.

Sale: Lower Rio Grande Valley, 5 acres, 2 homes, citrus, avocado, pecan trees, \$140k. x34107 or 210-687-2222.

Sale: Meadow Bend, 3-2-2, 1500 sq ft, lg kitchen, living room, storm windows, cul-de-sac, no neighbors in rear, 4 yrs old, \$84k. 334-2963.

Rent/Sale: Gulf Frwy Oaks, 3-1-1, remodeled, lg patio, yard, \$500/mo., or \$43k. 332-1614.

Rent: LC, The Landing, 3-2-2, 1500 sq ft, FPL, gas appl, W/D conn, ex cond, avail 5-22, \$700/mo + dep. Ted, 486-7103.

Cars & Trucks

'85 Ford Mustang 5.0 G.T., auto, t-tops, orig owner, \$5k OBO. x33736.

'86 Mazda 626, 5 spd, 4 DR, new paint, AC, 73k mi, one owner, runs great, \$3.5k OBO. x31267 or 482-4953.

'91 Nissan Stanza, wht, auto, 40k mi. 286-1640.

'87 Toyota Corolla SR5, 5 spd, AM/FM/cass, AC, one owner, ex cond, \$3k. Mike, x31798 or 585-2416.

'78 Porsche 928, brwn, leather int, auto, ex cond, 75k mi, \$8.5k. Bill, x48889.

'89 T-Bird SC, navy blue, 72k mi, loaded, CD player, leather int, ex cond, new tires, \$8.9k. 283-1220.

'91 Jeep Renegade, hardtop, AC, loaded, red/blk, 12k mi, ex cond, \$14.9k. Tom, x41119 or 534-4958.

'91 Toyota Camry, low miles, dk blue, ex cond, \$11.5k. Frank, x48758.

'89 Dodge Colt, 3 dr, hatchback, 5 spd, AC, nonsmoker, runs great, blue/met, \$3.3k. Rick, x48840 or 480-9454.

'72 Buick Skylark custom, 350 Cl, new paint, new int, good motor, \$2k OBO; '67 Chevelle, restored, ex cond, \$5k. 920-7356 or 996-8610.

'83 Ford LTD wagon, all pwr, AC, extra seat in back, \$1.8k OBO. 489-4766.

'70 VW Bug, custom int, clean body, ex cond, \$2k. Rick, 334-2036.

'85 Lincoln TC, loaded, vinyl roof, one owner, ex cond, \$4.5k. 488-1320.

'87 Ford Tempo, 4 DR, standard, 80k mi, \$1k. 538-1051.

'84 Chevrolet Suburban Silverado, 4 wheel drive, new Sony AM/FM/cass, cold front/back air, traslom pkg, \$4.8k. x34107 or 332-0427.

'71 Chevy Nova, V8, orig owner, \$4.5k. 480-1998.

'90 Lincoln TC, Signature Series, wht/gray, loaded, car phone, low miles, \$17.4k. Tom, x41119 or 534-4958.

Boats & Planes

'89, 20' Cuddy Cabin, 125 hp outboard, galv trlr, garaged, low usage, \$6.5k. Roger, x31928 or 996-7674.

Half interest in IFR P-35 Beech Bonanza, \$15k. Steve, 244-9625.

'91 Cajun 1850 Fishmaster, center console, V-hull, shallow draft, '93 Merc 135, PT&T, SS prop, trolling mtr, 40 gal fuel tank, 3 batt, 72 qt Iglou aerater baitbox, \$11k. Gary, 534-3080.

'18' Prindle w/trlr, new sails, dbl trapeze, ex cond, \$1.8k; 22'4 Gulf Coast sailboat, fixed keel, main, jib, spinnaker, new uphol, 6 hs Johnson, new paint, \$2.5k. Greg, x32259 or 474-7634.

22' Chrysler sailboat, 5 hsp Nissan O/B, sleeps 6, sanded, 3 sails, \$2k OBO. 409-245-5290.

'16' laser sailboat, \$500. 538-1051.

'61" surfboard, Mike Myers, great shape, \$160. Keith, 332-2930.

'14' fiberglass bass boat, hull, 40 hp Mercury outboard, \$850. x40080 or 474-7923.

Cycles

'83 Kawasaki 440 LTD, not running, \$300. Keith, 332-2930.

'88 Honda Hawk 650 motorcycle, 2 helmets, low miles, \$2k. 481-0272.

JSC

Dates & Data

Today

NSS meets — The Clear Lake Area chapter of the National Space Society will meet at 7 p.m. May 10 at Freeman Memorial Library. NASA engineer Jack Bacon will discuss "Space Station Freedom Evolution and Redesign." For more information, call Marianne Dyson at 486-4747.

Cafeteria menu — Special: Italian cutlet. Entrees: braised beef ribs, chicken a la king, enchiladas with chili. Soup: cream of broccoli. Vegetables: navy beans, Brussels sprouts, whipped potatoes.

Tuesday

Cafeteria menu — Special: stuffed cabbage. Entrees: turkey and dressing, round steak with hash browns. Soup: beef and barley. Vegetables: corn cobbette, okra and tomatoes, French beans.

Wednesday

Change seminar — "You Say You Want a Revolution?" a no-holds-barred intellectual free-for-all discussion of specific proposals for real change at NASA will be held at 11:30 a.m. May 12, 19 and 26 in the Bldg. 3 cafeteria. Michael Roberts, an attorney and NASA engineer for nine years, will moderate the discussion of NASA's mission, NASA management, NASA-contractor relations, NASA and the individual. Call Roberts at x36632 for more information.

UH seminar — The American Institute for Aeronautics and Astronautics and the Institute for Electrical and Electronics Engineers education committees will present a

free seminar on "Space Activities in the College of Engineering at the University of Houston" at 10:30 a.m. May 12 at the Gilruth Center. For reservations, call Frankie Hap at 333-6064.

Toastmasters meet — The Spaceland Toastmasters Club will meet at 7 a.m. May 12 at the House of Prayer Lutheran Church at the corner of Bay Area Blvd. and Reseda Drive. For more information, call Jim Morrison at 480-9793.

Astronomy seminar — The JSC Astronomy Seminar will conduct an open discussion meeting at noon May 12 in Bldg. 31, Rm. 129. For more information, call Al Jackson at 333-7679.

Freedom Fighters meet — The Space Station Freedom Fighters will meet at noon and 5 p.m. May 12 in Rm. 160 of the McDonnell Douglas Tower, Space Center Blvd. and Bay Area Blvd. For more information, call David Cochran at 482-7005.

Cafeteria menu — Special: pepper steak. Entrees: catfish with hush puppies, roast pork with dressing. Soup: seafood gumbo. Vegetables: broccoli, macaroni and cheese, stewed tomatoes.

Thursday

SSQ meets — The Society for Software Quality will meet at 5:30 p.m. May 13 at the Days Inn on NASA Road 1. Bill Cottrell, Rockwell project manager for the Reusable Object Software Environment, will discuss "Integrated Cost, Schedule and Quality Metrics." For more information, call Felix Balderas at x31945.

Cafeteria menu — Special: chick-

en fried steak. Entrees: beef tacos, barbecue ham steak, Hungarian goulash. Soup: turkey and vegetable. Vegetables: spinach, pinto beans, beans.

Friday

Cafeteria menu — Special: tuna and noodle casserole. Entrees: liver and onions, deviled crabs, roast beef with dressing. Soup: seafood gumbo. Vegetables: whipped potatoes, peas, cauliflower.

Monday

Cafeteria menu — Special: breaded cutlet. Entrees: beef chop suey, Polish sausage with potato salad. Soup: French onion. Vegetables: okra and tomatoes, green peas.

May 19

AAS Spring Symposium — The American Astronautical Society's Southwest Section will present a spring symposium on "New Technologies and Current Events" from 8:30 a.m.-5 p.m. May 19 at the Gilruth Center. Keynote speaker will be JSC Director Aaron Cohen. Luncheon is \$8; reservations are due May 14, call Kim Hitt at 212-1200.

Astronomy seminar — The JSC Astronomy Seminar will meet at noon May 19 in Bldg. 31, Rm. 129. Dr. Hans Blome of the German Aerospace Research Establishment, will speak about the "Cosmic Black Body Background and the Big Bang Model of the Universe." For more information, call Al Jackson at 333-7679.

'88 Honda Hurricane 600, new tires/batt, 12k mi, scratched but runs great, \$2.1k. Wally, x36440 or 326-2664.

'88 Hurricane, 18k mi, red/blk, \$2.7k OBO. x34204 or 480-2954.

Honda XL-250S, street/rail, good cond, \$600 OBO. 485-7629.

Audiovisual & Computers

Mac sw: Aldus PageMaker 4.2a, \$349; Freehand 3.1, \$249; Illustrator, \$299; Mac IICx, 8 Meg RAM, 40 mb hd, Apple color monitor, extended kybd, AppleCare warr, \$2099, w/240 MB HD, \$2599. 487-0290.

Pioneer 45 watt rec, cass deck, Realistic 10 band equalizer, Advent Prodigy Tower spkrs, \$375 OBO. James, x33571 or 337-5583.

Beehive data terminal, \$50; RS232 serial interface; antique majic eye tape recorder, \$30. Walter, x37332.

Apple IIC computer w/13" color monitor, joystick, ImageWriter printer, \$250. 482-0765.

Compaq 286 DP, 50 MB HD, 1.2 MBFD, mono monitor, mouse, Mac Omnipage Direct, \$240; Turbo Pascal 4.0, \$25. 484-4627.

486SX, 25 Mhz, 4 MB RAM, 3.5 and 5.25 FD, SVG monitor, 1 MB SVGA CARD, 213 MB HD, IDE, controller w/25,1p,16, \$1335. 286-6561.

Atari 1040ST, 1 MB RAM, color, MIDI interface, complete sys, some software, \$350. 286-2713.

Bose 901 Series VI spkrs, new, w/equalizer, 5 yr warr, was \$1.5k, now \$1195. John Pembroke, x47029 or 944-0760.

Pets & Livestock

Himalayan/Persian kittens, all colors, health guarantee, \$200-\$500; stud service avail, fee nego. Kristy, x30108 or 286-0146.

Free kittens, blk, wht. Jody, x36726.

AKC, male Siberian husky, 2 yrs old, neutered, current shots, \$100. Greg, x32259 or 474-7634.

Breeding, AKC reg, male, tiny toy poodle, apricot, stud fee \$30. Rick, 334-2036.

Lost & Found

Lost one small gold nugget hoop earring, pierced, in the vicinity of Bldg 4 S, 4-14. x48148.

Household

French Provincial sofa, fruitwood, beige. 282-4849 or 941-3262.

12 cu ft Coldspot upright frostless freezer, \$100; 2 dk green uphol chairs, \$25/ea; 2 Hollywood twin beds w/corner hide-away, \$75/ea. Richard, x33161 or 481-1518.

Blk lg loveseat, chair, 3 mos old, \$450. x39172.

Super single waterbed matt, frame, heater, 6 drwr under dresser, \$75 OBO. x36397 or 482-5780.

Sears 30" gas slide in range, elec ignition, Sears vent hood w/light fan, \$50 or w/same hood, new, hung in box, all avocado green, all ex cond, \$75. 331-0611.

Qn sz semi-motionless waterbed, Jones Town hdbd w/centered oval mirror, vanity shelf, etched glass doors, tulip lamps, 12 drwrs, heater, 4 mos old, ex cond, \$600. 420-3822.

Glass dining tbl, 4 chairs, tbl 4' long, 3' wide, 1/2 inch thick, \$175. Brent, x36456.

New Frigidaire portable or builtin dishwasher, pwr scrub, water heating, heat/no heat fan dry, was \$425, make offer. x34107 or 332-0427.

Kg sz waterbed, oak frame, connecting nightstands, motionless matt, access, \$350 OBO. Robert, 282-2991 or 480-9672.

Wanted

Want students to join Russian language class taught by a Rice University professor; students should be at intermediate/beginner level w/at least 6 mo to 2 yrs experience. Rick, x47373 or Keith, x38024.

Want two children's bicycles, boys age 5 and 7. Andy, 332-9105.

Want Mac II computer or equivalent, Mac only. 280-8796.

Want outdoor plants, free or small amount of money, overgrows OK. 286-1640.

Want 286 computer complete w/40 MB HD or higher, must be reasonable. 488-5564 or 784-1497.

Want donated matt, furniture, household goods, cookware, toys for Vietnamese refugees, items can be picked up, receipts given. Mai Pham, x31786.

Want air compressor, tools, at least 15 gal tank and 2 hp. x33433 or 471-6175.

Miscellaneous

10" Wards chain saw, \$35; Webcore reel-to-reel antique tape recorder, needs repair, \$30; Frigidaire elec clothes dryer, \$45. Walter, x37332.

Folding wheelchair, \$75; foldable walker, \$25; adjustable bath bench, \$25; toilet rails, \$20. Richard, x33161 or 481-1518.

Old school teacher's desk, \$60; Truck cap, red, fits full sz Chevy PU, good cond, \$350. 996-1442.

Indy 500 tickets, turn 1, SE Vista, pair of seats, \$270. 326-5150.

Girls Riedell prof ice skates, wht, sz 1, blade cover, was \$115, now \$25. 331-0611.

SW airlines frequent flyer voucher for roundtrip, good until 10-27-93, \$325 OBO. Tracy, x47120 or 486-3946.

Chess set, carved from sandalwood, lg pcs, chess board intricately designed, \$199. 283-1220.

Wedding veil, wht, new, tags still attached, was \$163, now \$85. 332-8017.

Couch, 6 pc sectional, \$300 OBO, Pres & 1st Lady club membership, \$400 OBO; Singer sewing machine, maple cabinet, \$100. 482-9601.

Kg sz bed, ex cond, \$400; wht twin bed frame w/hdbd/ftbd, \$75; Wards side-by-side refrig/freezer, \$300; Oriental rug, \$45; mirrors; qn sleeper sofa, \$70; brwn swivel rocker, \$30; wht iron/glass etagere, \$50; overstuffed chair, \$40; end tbl, \$15; wall coverings. Marcia, x30195 or 486-1844.

Twin bed w/frame, ex cond, \$100; 2 blk 6' halogen lamps, nonworking, \$10/ea or \$15/pr. Karen, 280-8822.

Golf cart, "Little Brut", new, \$25; girl's 20" bike, \$25; Larry Dyke limited and numbered prints, sell all or indiv. 482-7546.

5 pc sectional w/rocker/recliner, green, pinstripping, 1.5 yrs old, \$750; 26.6 cu ft GE refrig, blk face, 1.5 yrs old, \$950. x41119 or 534-4958.

Wurlitzer funmaker organ w/stool, ex cond, \$200; Joy Walkers ladies walking shoes, sz 9N, \$50. x38624 or 475-9671.

4 16.5" American racing chrome rims w/sleeves, 36" Goodyear military mudders for Ford F250, 3/4 ton 4x4, was \$1.6k, now \$400. Mike, x37640 or 946-6880.

2 swivel barrel LR chairs, uphol, good cond, \$50 OBO; Chinese print, framed picture, \$50 OBO. 996-6062.

Backswing, hang upside dw, \$100; minitrampoline, \$100. Doug, 280-2374.

Exer bike, \$25; stairclimber, \$25; wood exec desk, \$40; metal detector, \$200, kg sz bed/matt, \$350. LaVon, x31138 or 486-1187.

Chipper/shredder elec start, 8hp, extra grate, tow bar tray built, \$800; '77 Toyota Celica, air, \$1.2k; Yamaha 86 Virago, \$1.6k. 332-6266.

Wht, beaded, Qn Anne wedding gown w/full train, sz 10, \$600; Symphony veil, wht, \$200; hoop type slip, \$20; his & hers 18 spd mountain bikes, \$300. 484-4304.

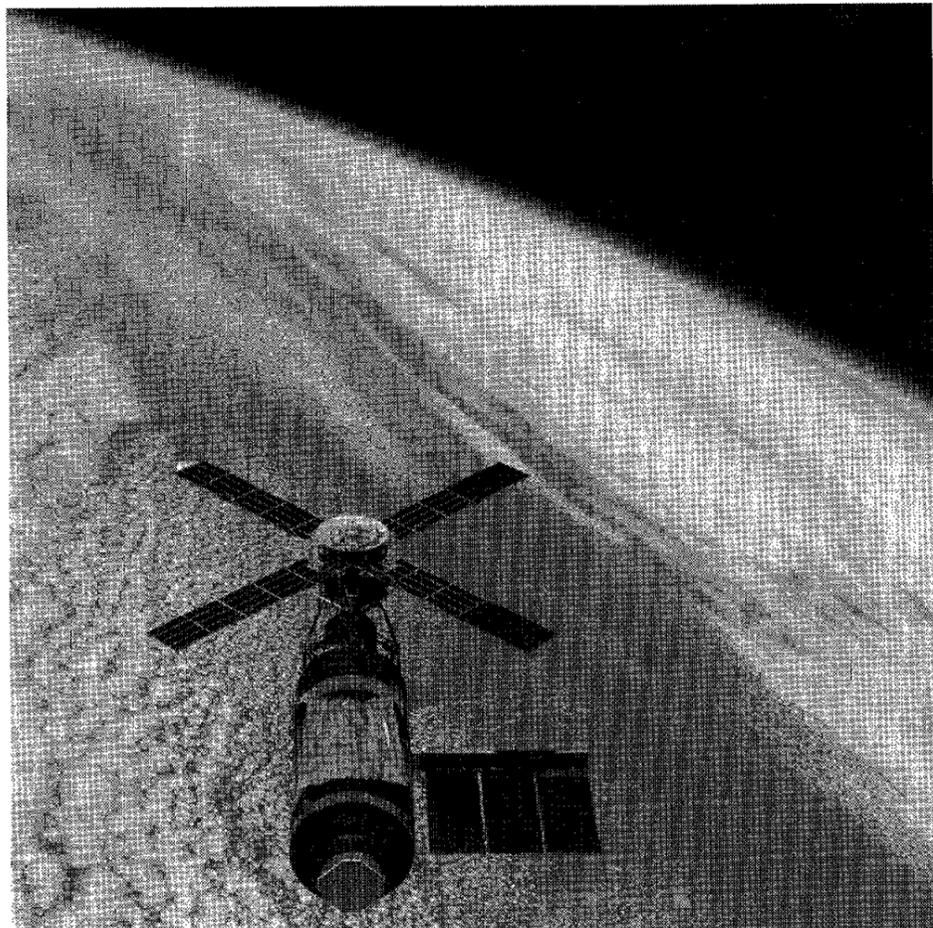
Van captains chairs, high backs w/arms, skirts, pockets, swivel, full recline, \$350 OBO. x36687 or 947-3904.

Two Pres & 1st Lady Gold Charter membership, \$600/ea. Sandy, x49875 or 480-0125.

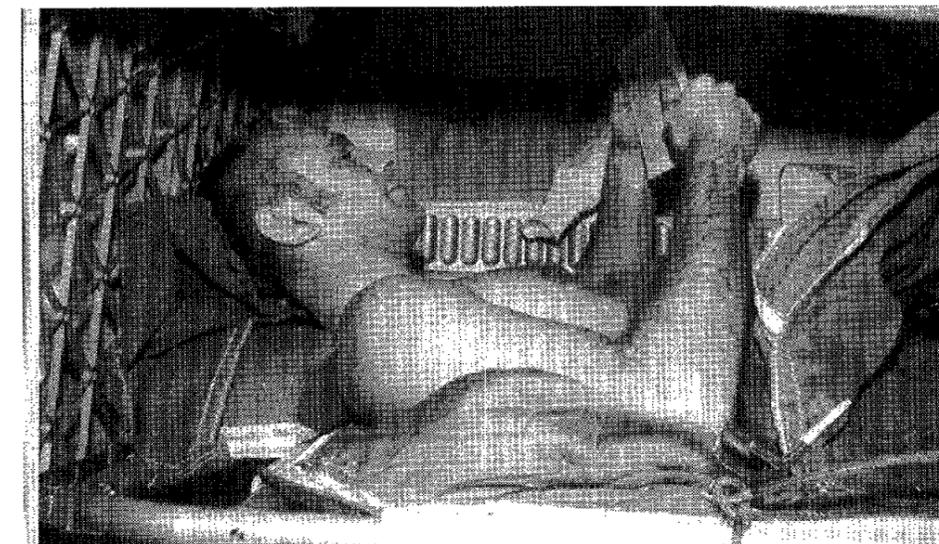
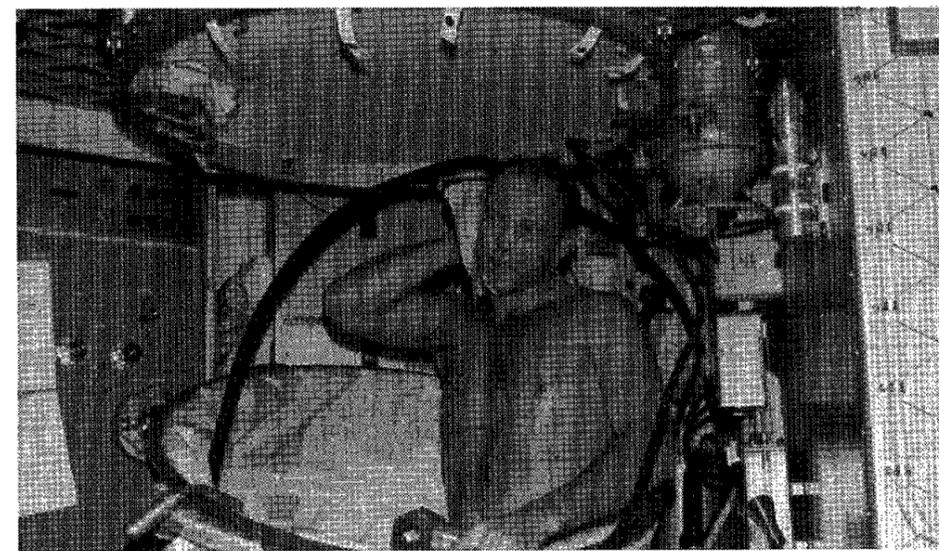
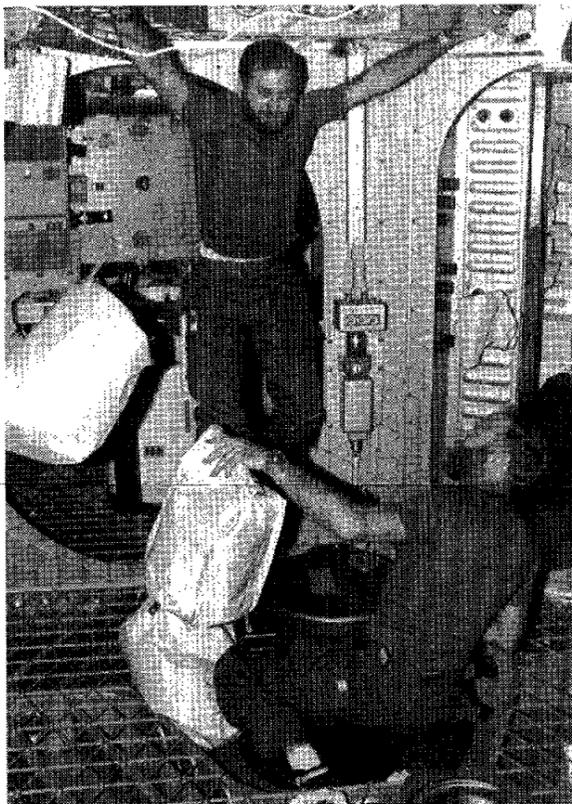
Glass top tbl, 4 chairs, blk, ex cond, \$250; antique English oak tbl, 4 chairs, \$300. x39593 or 326-6401.

Wht, beaded, fitted, wedding gown, v-neck, long sleeves, sz 8, \$600. x39172.

Matching sofa/chair, wood coffee tbl, \$65; Smith Corona typewriter w/case, \$25; Mikasa Carisma Grey China, 8 place setting, add serving pc, make offer. Clay, x38133 or 280-0479.



Top: The Skylab 4 crew in the Command and Service Module captures an overhead view of the Skylab space station during the final fly-around before returning home. Right: Taking out the garbage on Skylab requires a little help from friends. Skylab 4 Pilot Bill Pogue holds onto the Orbital Workshop ceiling before he jumps onto the trash airlock hatch cover to force another trash bag toward the waste disposal system while Commander Jerry Carr assists. Below: Skylab 3 pilot Jack Lousma showers in the crew quarters. In deploying the shower facility, the shower curtain pulled up from the floor and attached to the ceiling. Water came through a push-button shower head attached to the hose and was removed by a vacuum system. Bottom: Skylab 3 Commander Alan Bean reads a book while relaxing in his sleep restraint in the crew quarters of the Orbital Workshop.



Learning from Skylab

Even after 20 years, lessons learned on America's first space station still hold promise for future endeavors

[Editor's note: This is the first of two stories celebrating the 20th anniversary of the May 14 launch of the Skylab orbital workshop.]

By Kelly Humphries

America's space program has evolved significantly in the 20 years since its first space station, Skylab, was put into orbit but lessons learned by three crews that spent a total of 171 days in orbit will still be valuable to designers of long-duration spacecraft.

Foremost in the minds of several of the Skylab astronauts today was the need to make future orbiting laboratories more like homes and offices on the ground, and to pare down the demanding work schedules of short-duration space flights when planning for longer tours of duty in orbit.

"People on orbit have the same needs as people do down here — Maslow's hierarchy of needs," said Jerry Carr, who commanded the Skylab 4 mission, spending 84 days in orbit with Bill Pogue and Ed Gibson. "A lot of the needs have to do with feeling good about yourself. The first levels are, you have to feel safe, you have to feel comfortable."

"One of the biggest problems we ran into on Skylab was scheduling," explained Carr, now a consultant to Boeing on space station matters. "When you tried to really carry out the kind of schedule we had over an 84 day mission, it just became brutal. You need time to wind down, you need time to go off and close the hangar door, get the work behind you and think about something else. You need time for creative thought, just like you do down here. That's a lesson we learned on Skylab, but we've never had to put it to work because we've never had a mission since then that lasted long enough."

The Skylab 4 mission has been credited by some for the first "mutiny" in space. But Carr said it wasn't that way at all.

"We got accused of turning off our radios and refusing to answer the people on the ground, and that's a bunch of hogwash. That never happened."

What happened was that about 40 days into the flight, the crew decided to take advantage of its one day off in 10 for the first time. At the end of the ninth day, Carr called down his standard report and added that morale was deteriorating because the crew felt rushed by such a demanding schedule and was making too many mistakes. A full conference was scheduled, and both the crew and flight controllers bared their souls.

After thinking about it for a day, the two parties decided to develop a "shopping list" of things that needed to be done each day at some time by someone. There was a separate schedule for events tied to the trajectory that had to be done at a precise time.

"The complexity of our schedule immediately reduced," Carr said. "Our productivity went up because all of a sudden we had some control over our own day."

That lesson, learned the hard way, should be applied to future long-duration flights, he said. It already has been applied to the shorter shuttle flights, taking shape in the timeline as pre- and post-sleep activities, the E-Z crew activity plan and shopping lists of get-to-this-when-you-can activities.

"You have a need to feel good about yourself and what that means is you have the need to be able to do your job right. That's one of the problems the scheduling crunch had on us. We were rushing so fast that we became prone to making mistakes and there wasn't time to correct them," Carr said. "I think what you're going to find is you are going to have to reduce the length of your work day from the 12 or 14 hours you're doing now to down closer to 8 to 10. You're going to have to allow people to just rest if you want to keep them productive."

Alan Bean, who commanded Skylab 3 and spent 59 days in orbit with Jack Lousma and Owen Garriott, said the kind of work that needs to be done on a space station may even require a different kind of astronaut.

"Long-term flight is different from short-term flight," Bean said. "You have to get a different mindset on how you're going to approach the day-to-day work because a lot of space station work is going to be very repetitive. Lots of potential crew members don't think that way. For pilots, it's perform at a high level for a short period, then relax and perform again at a high level. It's going to take an adjustment in thinking to be a good astronaut on a space station."

"Each of us goes to a profession because of a lot of other things. Living long-term on a space station will be more like extended duty on a submarine. Personality and character traits such as those are going to be more natural analogs for station work."

But no matter how homey a space station is or how many windows are available, everybody needs a real break now and then.

"Look at this office," said JSC Deputy Director Paul J. Weitz, who spent 28 days with Pete Conrad and Joe Kerwin as the first Skylab crew said. "I've got lots of windows. I wouldn't want to work 12 hours a day, seven days a week here. You just like to go out and do things you want to do at your own pace."

Schedule considerations won't be unique to the crews on long-duration spacecraft, said Frank Hughes, chief of the Mission Operations Directorate's Space Flight Training Division.

"Building a station of itself is not a big technical challenge — we're doing stuff we know how to do," Hughes said. "The question is, when you do it longer — and that's what got us in Skylab — the human element starts to assert itself. People in the control center have to be on console for months at a time instead of going out for seven days and then having a beer party at the Gilruth when the crew gets back home."

"Now, they go and they're just gone for 90 days in orbit, and we're on console all year long. Instead of the hard-charging space scientist kind of people, we're the FAA, it's Christmas Day and somebody's here working."

No one will have to put in 100 percent of every working day on console, he said. That will be taken care of with rotations for flight controllers. But there are other changes in the offing, too, that address the large numbers of people it takes to support a spacecraft carrying humans.

Mission Operations will have to redefine what "the office" is, Hughes said. That means multipurpose support rooms may be manned by people in their offices, and that there may not even be MPSRs when the space station is in its unmanned phase. The controllers in the Space Station Operations Control Room will monitor systems and the station will be designed to safe itself and wait for 24 hours in the event of a serious problem, just as unmanned probes do now as they wind their ways through our solar system.

"Just from the operations cost, we can't afford to have these standing armies of people waiting around in case something goes wrong," Hughes said.

Support personnel may have offices within 20 feet of the SSOCR, with real-time data at their fingertips through computer network connections, he said.

The people on the ground and in orbit will have to work hard at being sensitive to each other's needs, Carr said, or you'll end up losing productivity.

"Anywhere where you get a small group of people sequestered somewhere and a larger group of people trying to control or support them, if you don't have that sensitivity you're in danger of getting that us vs. them thing going," Carr said.

And whether you're talking about the crew on orbit or the flight controllers on the ground, the key, according to Bean, is flexibility.

"When you go up on a space station, every minute isn't going to count," he said. "Every day isn't going to count. It just isn't the way you do things on Earth. You've got to have a lot more flexibility." □

Hickmon new center ops deputy

James A. Hickmon has been appointed deputy director of center operations, succeeding Grady McCright who recently took over for retiring Center Operations Director Ken Gilbreath.

Joel B. Walker will succeed Hickmon as acting chief of the Logistics Division.

Hickmon joined JSC in 1967 in the Center Operations Directorate's Administrative Services Division and moved to the Logistics Division in 1980. In the Logistics Division, he held positions of progressively greater responsibility, including chief of the Supply Operations Section, chief of the Supply Branch, and deputy chief of the Logistics Division. He has been chief of logistics since 1992.

Walker joined NASA at Kennedy Space Center and transferred to JSC in 1986. He has held positions of increasing responsibility, including

chief of the Transportation section and JSC Transportation Officer. He has been deputy chief of the Logistics Division since 1992.

Krishen elected member of international group

JSC Chief Technologist Kumar Krishen has been elected a member of Commission F of the U.S. National Committee of the International Union of Radio Science.

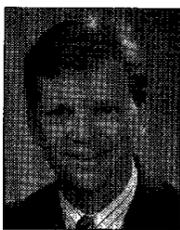
URSI (the French abbreviation is used) is one of 18 world scientific unions organized under the International Council of Scientific Unions dedicated to stimulate and coordinate studies in radio, telecommunications and electronic sciences.

Top secretary honors

Phyllis J. Buckley and Marla G. Duhon recently received the Marilyn J.



Hickmon



Walker



Krishen



Duhon



Buckley



Speller

Bocking Award for Secretarial Excellence.

Buckley, secretary to the manager of the Space Station Avionics Office, has made "significant contributions to the mission of the office to gain effective control of and to successfully manage this critical path component of the Space Station Freedom Program."

Buckley handled all correspondence, messages and daily schedules, prepared briefing materials, set up reviews with senior prime contract managers and NASA managers and

arranged travel on brief notice.

Duhon, secretary for the Space Station Systems Safety Branch, has established and maintained traceability logs on flight rules, crew procedures and launch-commit criteria and regularly provides status information to Safety Division board representatives. She also served as the classified materials custodian for flight support documentation in the division.

She was cited for supporting her supervisor, who managed the transition to the current Safety, Reliability and Quality Assurance contractor.

Student wins science fair

Kevin Speller, son of JSC Financial Management Division Chief Martha Speller, recently won top honors at the Greater Houston Science Engineering Fair for his project, "Electromagnetically Vectors and Extinguished Flames."

A senior at Clear Lake High School, Speller won the NASA Space and Life Sciences Excellence in Engineering First Place Award, the First Place Award in Engineering and was a Grand Award winner. He has been awarded a summer internship at JSC.

Lunch time debates eye big changes

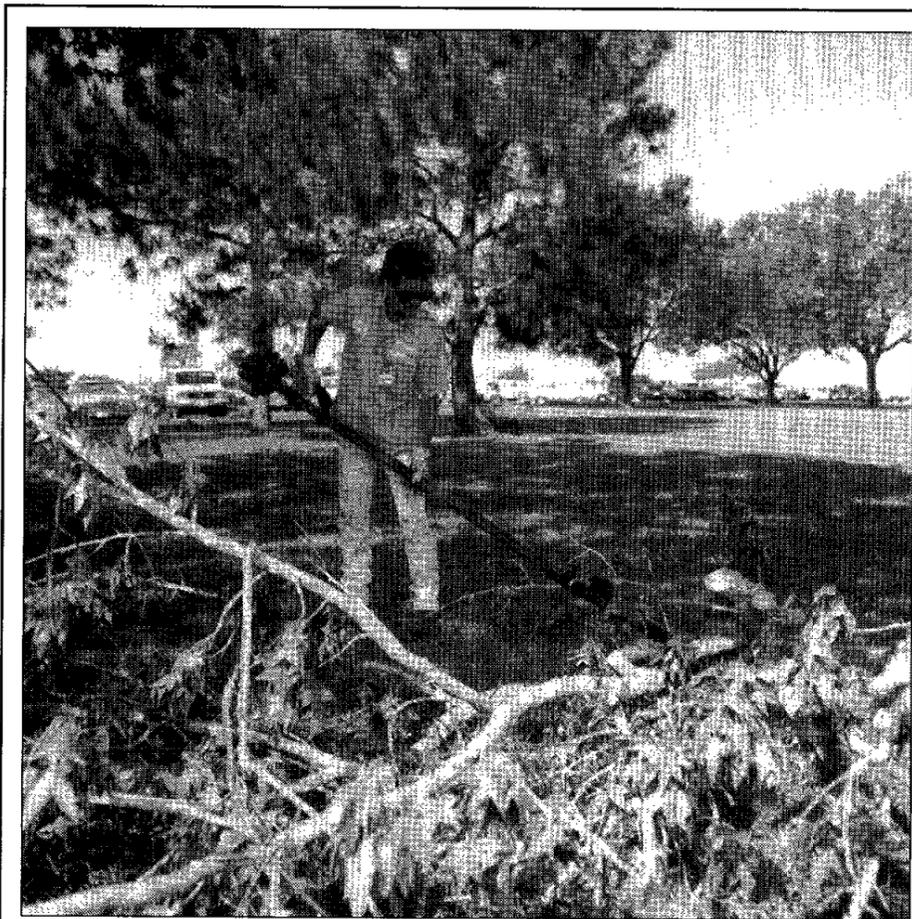
JSC employees and contractors who seek major reforms at NASA will have their say during a series of lunch time discussions each Wednesday in May.

Sponsored by JSC Threshold, the "You Say You Want a Revolution?" discussion series will be held from 11:30 a.m.-12:30 p.m. in the Bldg. 3 cafeteria.

"Each Wednesday, there will be a presentation on a specific proposal for radical change here at NASA, followed by audience participation in a no-holds-barred, free-for-all debate about the proposal and other NASA issues of concern," said Michael Roberts, an attorney and nine-year NASA employee who will moderate the sessions.

Topics to be discussed include "NASA-Contractor Relations" this Wednesday, "NASA and the Individual" on May 19 and "NASA's Mission" on May 26. The first discussion, held May 5, looked at "NASA Management."

For more information about the discussion series, call Roberts at x36632.



JSC Photo by Scott Wickes

SPACE CENTER DEBRIS—Gerry Stahler, a worker for JSC landscaping contractor Four Seasons Services cleans up debris from a recent weekend storm that downed branches around the center. Four Seasons crews were kept busy picking up after the winds last Monday.

NEBA office makes move

The NASA Employees Benefit Association life insurance office has moved from the NASA Exchange Operations Office in Bldg. 1 to the Employee Services Section in Bldg. 45.

Locating NEBA with other insurance programs in one office is designed provide one-stop shopping for all employee insurance needs.

The new mail code, telephone number and office location for NEBA now are the same as for other benefits.

For more information, call Employee Services at x32681, drop by the office in Bldg. 45, Rm. 140, or send a note to AH76.

Skylab anniversary celebration culminates Friday

(Continued from Page 1)

a special showing of the short film "On Human Destiny" and tours of the Skylab trainer. A limited number of passes are available; call x47514 to reserve a space.

From 10 a.m.-11:30 a.m. Friday, the space station mockup area in Bldg. 9 will be open for tours. Again, attendance is limited and you should call x47514 to reserve a space.

Teague Auditorium will be the site of a series of panel discussions and a display of Skylab memorabilia and operations products on Friday.

At 1 p.m., a payload operations panel discussion moderated by

Ronnie Lanier and featuring Larry Bourgeois (Corollary), Jack Knight (Biomed), Earl Thompson (Earth Resources) and Denny Holt (Apollo Telescope Mount) is planned.

At 2 p.m., a management and operations panel discussion moderated by Flight Director Milt Heflin and featuring Skylab Program Manager William Schneider, Skylab Operations Director Eugene Kranz, and Skylab Flight Directors Charles Lewis and Don Puddy will begin.

At 3 p.m., a Skylab crew panel discussion featuring Astronauts Paul J. Weitz, Joseph R. Kerwin and Story Musgrave is planned.

Additional Skylab astronauts may participate as their schedules allow.

Then, at 5 p.m., the combined Skylab 20th Anniversary Celebration and Mission Operations Directorate Spring Party will kick off at the Landolt Pavilion at Clear Lake Park. A barbecue dinner, refreshments and music by Monica Marie and the Mizconducts will be available for \$7 per person. For ticket information, call Karen Hardgrave at x41127.

For the latest information on the schedule, call x40033. For general information, call Bill Schaefer at x47672, or Ted Kenny at x40078.

Small Business Week

Top JSC buyers, Eagle Technical receive honors

JSC named Betty Holt and Krystine Bui, contract specialists in the Office of Procurement, as Small Business Buyers of the Year for 1992 and nominated Eagle Technical Services for a top federal award as a part of Small Business Week, May 9-15.

Holt was honored for cooperative efforts that resulted in the largest number of new awards to small businesses by a JSC buyer. Bui earned recognition for having the largest dollar volume of new awards to small businesses during fiscal 1992.

Eagle Technical Services, a prime contractor to the ACRV Project Office, will be presented the Small Business Administration "Award of Excellence" in Washington, D.C. JSC nominated Eagle for the award.

Each year, the President proclaims Small Business Week to recognize the contributions of the nation's millions of small business firms.

"NASA since its inception has recognized the potential of the small business community and has worked actively to utilize the capabilities within those companies," said Bob Dupstadt, JSC small business specialist. During fiscal year 1992, JSC placed more than \$136 million with small business firms.



Holt



Bui

Space News Roundup

The Roundup is an official publication of the National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Texas, and is published every Friday by the Public Affairs Office for all space center employees.

Dates and Data submissions are due Wednesdays, eight working days before the desired date of publication.

Editor Kelly Humphries
Associate Editor Kari Fluegel

Spacelab experiments bring back data on humans, plants, materials

(Continued from Page 1)

transmitted 3-D video images of how heat, transportation of elements and solidification in transparent materials work, and the Robotics Experiment's ROTEX arm was controlled precisely from the ground even through a deliberate breakdown. ROTEX even captured a free-flying object while being controlled from the ground.

Ross and Harris were able to grow a gallium arsenide crystal more than 20 millimeters in diameter, twice as large as any produced in space before. D-2 materials researchers hope to develop better production techniques for the material that is used in computer chips.

The crew was able to produce a

bismuth aluminum alloy in which bismuth drops were moved into specific positions, which were retained during solidification. Positioned drops may be useful as bearings because they can withstand higher loads and temperatures and improve efficiency, allowing for smaller, lighter, cleaner burning engines.

As part of the D-2 investigations of how the human body reacts to zero gravity, four crew members underwent injections of about two liters of saline solution that temporarily replaced body fluids they had lost. Replacing fluid quickly and taking careful measurements such as an echocardiogram, blood samples and breathing evaluations before and

after the infusions are expected to give insight into better ways to ease astronauts' return to gravity.

Walter, Harris and Schlegel ingested a special tracer amino acid for a study of whole-body nitrogen turnover. Investigators want to better understand the interaction between the observed loss of nitrogen and muscle function and size under microgravity conditions. The astronauts monitored their diets before the mission so that investigators could determine each one's 24-hour energy requirements and dietary composition. The tracers were expected to show up in the blood and urine samples collected over a 12-hour period during which

the astronauts ate special meals that provide specified amounts of nutrients.

Harris and Schlegel also took part in an experiment that studied how much insulin their bodies produced. They had to start their 12-hour work shifts taking a dose of glucose and then giving three blood samples before eating a late breakfast.

As the crew worked on its experiments inside the Spacelab, the Galactic Ultrawide-Angle Schmidt System Camera took wide-angle ultraviolet images of the Milky Way galaxy intended to extend the knowledge of our galaxy, and of the Earth's upper atmosphere.

The Modular Optoelectronic

Multispectral Stereo Scanner behind the Spacelab module in the payload bay also took digital, long-range stereo images of the Earth's surface for use in cartography, and land use, ecology and geology studies.

There were some disappointments, such as the death of all the tadpoles in three of four STATEX tanks visible to the crew. The experiment was designed to examine the development of the tadpole's vestibular, or balance organ.

"If you plan a mission like this with that many experiments that complicated you can't expect that everything is going perfectly," Brungs said Wednesday. "We are above expectations, that's for sure."